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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/522,839	06/06/2005	Joachim Kiefer	12834-00006-US	4211

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EXAMINER	
HU, HENRY S	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/522,839	KIEFER ET AL.	
	Examiner	Art Unit	
	HENRY S. HU	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *Election of April 22, 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) *17-22* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16 and 23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-23* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to **Election** filed on April 22, 2009, which is response to Restriction requirement filed on March 25, 2009. **Applicant's Election of Group I, Claims 1-16 and 23 is traversed with remarks on pages 2-3.** The traversal is on the ground(s) that no lack of unity objection is raised for PCT application. It would thereby not place an undue burden to search and examine the non-elected three groups including Group II (Claims 17-18), Group III (Claims 19-21) and Group IV (Claim 22) with the elected Group I. This is not found persuasive. For instance, Group I is drawn to **a proton-conducting polymer membrane** (it is a product by process claim according to MPEP), Group II is drawn to **an electrode**, Group III is drawn to **membrane-electrode unit** and its **fuel cell**, while Group IV is drawn to **a process of making** a proton-conducting polymer membrane.

Each group is dealing with different subject matter. Although the subject matter from each group may comprise the same or similar type proton-conducting polymer membrane, its structure, function and application are indeed different. The Claim 19 in Group III may use any electrode as long as such an electrode is compatible with the membrane based on polyazoles. Polyazole polymers prepared by process other than the process as disclosed in Group I may be also applied. They are thereby not interchangeable.

2. The requirement is still deemed proper and is therefore made FINAL. **The structural elements are mutually exclusive and the search terms are also mutually exclusive, thus they indeed create an undue burden on the Examiner**. USPTO has received **Pre-Amendment** and **three IDS'** (1 page each) so far. This Application is a **371/PCT/EP04/09461.** With such a pre-amendment, **Claims 3-4, 6, 10, 15-16 and 18-21 are amended; new claim 23 is added, while no claim is cancelled**. It is to only eliminate improper multiple claim dependency. **Claims 1-23 are pending now** with a total of **three** independent claims (Claim 1, Claim 17 and Claim 22), while non-elected three groups including Group II (Claims 17-18), Group III (Claims 19-21) and Group IV (Claim 22) are all withdrawn from consideration by the examiner. An action follows.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

On **Claim 1 at lines 2, 8 and 12**, three words "**obtainable**" render the claim **indefinite** because it is **unclear** whether the limitation(s) following the phrase are part of the claimed invention. The word "**obtainable**" is a relative terminology. According to MPEP, it is not

clear which range controls the actual metes and bounds of the claimed subject matter or **whether it is indeed obtained**.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. The limitation of parent **Claim 1** in present invention relates to ***a proton-conducting polymer membrane comprising polymers containing phosphonic acid groups*** *which is obtainable by a process comprising* ***four*** *steps:*

(A) ***mixing of vinyl-containing phosphonic acid with*** *one or more* ***aromatic tetraamino compounds with one or more aromatic carboxylic acids, esters thereof, acid halides thereof or anhydrides thereof which contain at least two acid groups per carboxylic acid monomer,***

and/or mixing of vinyl-containing phosphonic acid with one or more aromatic and/or ***heteroaromatic*** *diamino carboxylic acids, esters thereof, acid halides thereof or anhydrides thereof,*

(B) ***heating*** *of the mixture obtainable according to step (A) under inert gas at temperatures of* ***up to 350°C to form polyazole polymers****,*

(C) ***application of a layer*** *using the mixture from step (A) and/or (B)* ***to a support****,*

(D) ***polymerization*** *of the vinyl-containing phosphonic acid present in the sheet-like structure obtainable according to step (C).*

See other limitations of dependent ***Claims 2-16 and 23****.*

6. **Claims 1-16 and 23** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Suzuki** et al. (US 6,607,856 B2) in view of a combination of **two** references including **Kreuer** et al. (US 6,264,857 B1) and **Sakaguchi** et al. (US 7,288,603 B2).

Parent **Claim 1** relates to **a proton-conducting polymer membrane** in the form as IPN network structure according to the art. Said "IPN" membrane is useful for polymer electrolyte fuel cells (see title). It is fundamentally **made by a process of using vinyl-containing phosphonic acid as monomer with other precursors so as to first make polyazole in the form as sheet-like structure** and then polymerizing vinyl-containing phosphonic acid within the chains of polyazole. To be specific, the proton-conducting polymer membrane is obtained from **four** sequential steps including: (A) mixing the precursor (for making polyazole type

polymer) with vinyl-containing phosphonic acid, (B) heating the mixture from (A) to obtain polyazole type polymer, (C) applying of a layer using the mixture from (A) or (B) to a support, and (D) polymerizing the vinyl-containing phosphonic acid present in the sheet-like structure from (C). Open language "**comprising**" is applied to the four-step process of parent Claim 1.

7. **Suzuki** has already disclosed the preparation of **a high-durability solid polymer electrolyte membrane** to be in the particular form as **interpenetrated polymer network** (IPN) structure so as to be useful for fuel cell application (see abstract, line 1-13; column 1, line 7-14). Suzuki's process is particularly shown on **Figure 9** by **polymerization and/or crosslinking a monomer within the polymeric chains** so as to form IPN structure. Attention is directed to the fact that **such a monomer** used in several working examples such as **Examples 1, 3 and 5** can be the claimed **vinylphosphonic acid** (see column 9, line 45-48; column 11, line 61 – column 12, line 7; column 12, line 46 – column 13, line 24), while **such a polymer** can be polyether sulfone (PES) or polyether ether ketone (PEEK) (see working examples 1, 3 and 5). In order to see unexpected results, Suzuki has actually obtained the IPN final product (see Figure 8) by each of **two** different approaches including: (A) by making a polymer blend product by directly mixing poly(vinylphosphonic acid) with other polymer, and (B) by **following the process in Figure 9** as **polymerization and/or crosslinking a monomer, which is present within the polymeric chains**.

8. Therefore, Suzuki is "only" silent about **two** things including: (A) adding or replacing (polyether sulfone (PES) or polyether ether ketone (PEEK)) with polyazole type polymer, and

(B) using precursors to prepare the polyazole polymer. A combination of **two** references including **Kreuer and Sakaguchi** has taught two silent things (A) and (B).

With respect to silent (A) thing, **Kreuer** teaches that proton conductors can be prepared by comprising **two** components including: (A) **high molecular weight polymeric acid including phosphonic acid (-PO^3H)** (column 2, line 15-50), and (B) **amphoteric polymeric material such as polyazole type polymer** (column 3, line 7 – column 4, line 22). By doing so, such proton conductor membranes are found to be thermally stable over a wide range and can maintain high conductivities in many applications as specified (column 1, line 6-10).

With respect to silent (B) thing, **Sakaguchi** teaches that **polyazole type polymer can be readily prepared by directly heating from the claimed precursor mixtures** including: (A) amine compound and (B) carboxylic acid compound, which both precursor compounds are as disclosed in **instant dependent Claims 2-8**. See column 4, line 33 – column 12, line 45.

9. In light of the fact that all involving references are dealing with the making of proton-conducting membrane for fuel cell application and the proton exchange or proton conductivity is thereby the current key issue. Therefore, one having ordinary skill in the art would have found it obvious to modify Suzuki's process of making a proton-conducting membrane by either adding or replacing (polyether sulfone (PES) or polyether ether ketone (PEEK)) with polyazole type polymer as taught by **Kreuer** as well as the desired polyazole polymers are prepared directly from the claimed precursor mixtures including amine compound and carboxylic acid

compound as taught by **Sakaguchi**. Therefore, better and more efficient proton-conducting polymer membranes may be obtained since such proton conductor membranes may be thermally stable over a wide range and at the same time also can maintain high conductivities.

10. Regarding **Claims 2-9 and 23**, the disclosure of **Sakaguchi** at column 4, line 33 – column 12, line 45 as well as the references cited therein has taught and/or at least suggested the limitations of Claims 2-9 and 23 for using the claimed precursor mixtures of amine compound and carboxylic acid compound.

Regarding **Claim 10**, it is rejected since the claimed R factor can be just a bond or a bivalent alkyl group, while the claimed Z factor can be hydrogen atom. Suzuki has already applied such a type monomer. For instance, using vinyl phosphonic acid as monomer or using vinyl-containing phosphonic acid as monomer.

Regarding **Claims 11-16**, they are related to using crosslinker, photo-induced free radical polymerization and film preparation, which is routine as known in the art. The above-involved references and the references cited therein has taught and/or at least suggested the limitations of Claims 11-16. See working examples.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicants' disclosure. The following references relate to a proton-conducting polymer membrane based on using the vinyl-containing phosphonic acid as monomer with four steps as specified:

US 2007/0292734 A1 to Kiefer et al. has disclosed a process for producing a proton conducting electrolyte membrane for fuel cell application. It is only achieved by **irradiating a polymer film and then "graft"-polymerized a vinylphosphonic acid monomer**. See abstract, line 1-5; Claim 1 at page 16. **Vinyl-containing phosphonic acid is not polymerized within the chains of polyazole**. The IPN network structure is certainly not included. Therefore, Kiefer cannot teach or suggest the limitation of parent Claim 1.

12. Any inquiry concerning this communication or earlier communication from the examiner should be directed to **Dr. Henry S. Hu whose telephone number is (571) 272-1103**. The examiner can be reached on Monday through Friday from 9:00 AM –5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Vasu Jagannathan, can be reached on (571) 272-1119. The **fax** number for the organization where this application or proceeding is assigned is **(571) 273-8300** for all regular communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D. Mulcahy/
Primary Examiner, Art Unit 1796

/Henry S. Hu/
Examiner, Art Unit 1796

August 14, 2009